BEFORE THE

Federal Communications Commission

WASHINGTON, D.C. 20554

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of	)	
	)	
Petition of TRW Inc. for Amendment	)	RM-7773
of Sections 2.106 and 25.141 of the	)	
Commission's Rules to Allocate	)	
Spectrum for, and to Establish Other	)	
Rules and Policies Pertaining to,	)	
Satellite Systems in the RDSS Bands	)	

To: The Commission

REPLY COMMENTS OF TRW INC.

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SUMMARY

TRW Inc. ("TRW") hereby replies to the parties that commented on its Petition for Rule Making to establish the Mobile-Enhanced Radiodetermination Satellite Service ("M-E RDSS") in the 1610-1626.5 MHz and 2483.5-2500 MHz bands (the "RDSS bands").

In general, the comments support TRW's call for the preservation and revitalization of the RDSS service. Approval of TRW's Petition will enable the Commission to achieve the public policy objectives it established for the RDSS in 1986, and foster the creation of multiple competitive RDSS systems. Moreover, it will enable service providers to create economically viable, spectrum-efficient systems by combining RDSS with mobile satellite voice and data services.

The American Mobile Satellite Corporation ("AMSC") and Motorola Satellite Communications, Inc. ("Motorola") opposed all or part of the pro-competitive proposals advanced in TRW's Petition. AMSC is attempting to expand its proposed domestic mobile satellite system into a portion of the RDSS bands by means of a non-competitive proposal that would require the denial of all five of the other RDSS-band applications. Motorola also proposes a non-competitive system that is mutually exclusive with all of the other RDSS-band applicants.

AMSC's technical analysis is laden with flawed assumptions and mischaracterizations, and poses no bar whatsoever to the approval of TRW's Petition. AMSC applied improper protection standards for its sharing analyses, it

exaggerated the significance of multiple-satellite M-E RDSS constellations on terrestrial users in the 2483.5-2500 MHz band, and it completely miscalculated the user capacity of TRW's Odyssey system. Motorola's technical objections also lack merit, particularly its attacks on petitioners that propose to require the use of CDMA spread spectrum modulation.

TRW responds as well to the concerns expressed by National Academy of Sciences ("NAS") that the M-E RDSS service proponents have not yet demonstrated that sharing between M-E RDSS and radioastronomy users, inter alia, in the 1610-1613.8 MHz band is feasible. TRW has, in fact, satisfactorily addressed NAS's concerns in a July 1991 Erratum to its Odyssey system application that was overlooked by NAS.

Finally, TRW opposes Communication Satellite Corporation's call for Commission postponement of the RDSS-Band spectrum allocation proceeding until after the completion of WARC-92. Such a postponement would send the wrong message to the world about the U.S. Government's commitment to the RDSS and to improving the efficient and economical use of the bands. Comsat's alternative suggestion that the Commission commence a rulemaking that addresses only service and licensing issues is unnecessary. If the Commission were to establish the M-E RDSS allocation in the manner proposed in TRW's Petition, there would be no service rules to address.

In short, TRW urges the Commission expeditiously to grant TRW's Petition and commence a rulemaking proceeding to establish the M-E RDSS.

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In the Matter of	)	
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Petition of TRW Inc. for Amendment of Sections 2.106 and 25.141 of the Commission's Rules to Allocate Spectrum for, and to Establish Other Rules and Policies Pertaining to, Satellite Systems in the RDSS Bands	)	RM-7773

To: The Commission

REPLY COMMENTS OF TRW INC.

TRW Inc. ("TRW"), by its attorneys and pursuant to Section 1.405 of the Commission's rules, hereby replies to the comments that were filed in response to its above-captioned petition for rule making ("TRW Petition"). The comments generally support TRW's claim that it has advanced a pro-competitive proposal that will enable the licensing of multiple satellite systems in the 1610-1626.5 MHz and 2483.5-2500 MHz bands (the "RDSS bands") for the provision of a novel mix of radiodetermination satellite and mobile satellite voice and data services. The comments opposing TRW's Petition fail to undermine or otherwise alter the conclusion that grant of TRW's proposal is required in the public interest.

I. INTRODUCTION

Despite the fact that several of the RDSS-band applicants had filed or soon would file their own petitions for rule making, they nevertheless submitted comments in support of

TRW's Petition for Rule Making to establish what TRW calls the Mobile-Enhanced Radiodetermination Satellite Service ("M-E RDSS") in the RDSS bands. These commenters (namely Constellation Communications, Inc. ("Constellation") and Loral Qualcomm Satellite Services, Inc. ("LQSS")), along with Ellipsat Corporation ("Ellipsat") (petitioner in RM-7805), recognize that TRW's proposal will enable the Commission to achieve the beneficial policy goals it identified when it established the RDSS service more than six years ago, while simultaneously enhancing the economic viability of systems operating in the frequency bands by permitting them to provide RDSS-compatible mobile satellite voice and data services.

Notwithstanding the support that was expressed for TRW's proposal to establish a competitive satellite service in the RDSS bands, TRW's Petition (along with the rulemaking requests filed by co-applicants Constellation and Ellipsat), was opposed by American Mobile Satellite Corporation ("AMSC"), and to a lesser extent by Motorola Satellite Communications, Inc. ("Motorola"). AMSC and Motorola have separately proposed non-competitive uses of some or all of the 1610-1626.5 MHz band. Approval of the proposals of either AMSC or Motorola would require the denial of all of the other applications that comprise the June 3, 1991 processing group, and preclude competitive multiple entry by subsequently-proposed RDSS-band systems.

In its comments, the National Academy of Sciences' Committee on Radio Frequencies ("NAS") expressed concern that the use of the RDSS bands by M-E RDSS systems may cause interference to the radioastronomy service. It asserts that none of the petitioners has yet demonstrated the feasibility of implementing mobile satellite services in the 1610-1613.8 MHz band in a manner that escapes the use of avoidance zones around radioastronomy observatories, and is uncertain about the impact of proposals to use the 2483.5-2500 MHz band on radioastronomy operations at 4990-5000 MHz.

Finally, Communications Satellite Corporation ("Comsat") takes no position on the petitions themselves. Instead, it supports a comprehensive rulemaking proceeding to address the service and licensing issues raised by the RDSS-band applications, but urges the Commission to postpone the rulemaking on the various spectrum allocation proposals until after the conclusion of the World Administrative Radio Conference that will be held in February 1992 ("WARC-92").

As shown below, the comments filed in support of TRW's Petition demonstrate that TRW's proposal will enable the establishment of an economically viable satellite service in the RDSS bands that is consistent both with the Commission's competitive multiple entry policy for the satellite industry, and with the policies and rules established in the Commission's 1986 order establishing the RDSS service. In no way can the

Commission approve either of the non-competitive and spectrum-inefficient proposals that were advanced by AMSC and Motorola, since to do so would require it to stifle competition in favor of a monopoly service provider -- a result that cannot be found consistent with the public interest.

TRW also shows that NAS's concerns with regard to TRW's potential impact on radioastronomy operations were fully addressed in an erratum to TRW's application. Finally, TRW urges the Commission to reject Comsat's call for postponement of the spectrum allocation rule making, as any delay could jeopardize the prospects for approval of the global allocation for RDSS services that is being advocated by the U.S. Government.

II. DISCUSSION

A. The Comments Support TRW's Call For Establishment Of A Competitive, Mobile-Enhanced RDSS Service In The 1610-1626.5 MHz And 2483.5-2500 MHz Bands.

Including TRW, four of the six applicants in the June 3, 1991 processing group have supported TRW's Petition, either in their own petitions for rule making (see Ellipsat Petition for Rule Making, RM-7805, at 4 n.6) or in their comments in this proceeding. Constellation, for example, recognizes that TRW's proposal, through its requirement that RDSS-band systems operate using code division multiple access ("CDMA") spread spectrum transmission techniques, is fully consistent with the

Commission's policy favoring competitive multiple entry. Constellation Comments at 3-4. Constellation also recognizes that TRW's proposal provides the Commission with a way to advance the objectives of preserving and revitalizing the RDSS service Id. at 3.

LQSS, which recently filed its own petition for rule making, supports the key elements of TRW's Petition -- namely, the amendment of the Commission's rules to allow provision of mobile voice and data services in conjunction with RDSS services, the relaxation of downlink power flux density ("PFD") limitations in the 2483.5-2500 MHz band, and adoption of modulation requirements that will permit multiple nongeostationary satellite systems to operate in the RDSS bands (i.e., CDMA spread spectrum modulation). LQSS Comments at 8. The continuing value of the RDSS is established beyond dispute by the fact that five applications for authority to provide RDSS services are now pending. LQSS correctly notes that the Commission has provided the service with a strong vote of confidence by virtue of its recommendation that the delegates to WARC-92 allocate the 1610-1626.5 MHz and 2483.5-2500 MHz bands to the RDSS on a primary basis in all three regions of the globe. LQSS Comments at 7. See also An Inquiry Relating to Preparation for the International Telecommunication Union World Administrative Radio Conference for Dealing with Frequency Allocations in Certain Parts of the Spectrum, 6 FCC Rcd 3900 (1991) ("WARC-92 Inquiry Report").

There can be no doubt but that TRW's Petition presents the Commission with a way to accomplish its original public interest goals for the RDSS service -- including the objective that competitive multiple entry be ensured -- while also affording applicants an opportunity to provide a mix of in-demand satellite services that will allow operators to achieve economic viability in a manner that cannot be accomplished through an RDSS-only system. Four of the six RDSS-band applicants believe they can be authorized to operate CDMA spread spectrum M-E RDSS systems simultaneously, if TRW's Petition is granted. Five out of six applicants would have to be dismissed if the proposals of either AMSC or Motorola are approved. The choice is clear.

B. TRW's Pro-Competitive M-E RDSS Proposal Must Be Approved Over Either Of The Non-Competitive Proposals Advanced By AMSC And Motorola.

1. AMSC's Technical Opposition To TRW's Proposal For The M-E RDSS Is Fatally Flawed.

AMSC puts forth a number of technical reasons why the petitions of TRW, Constellation, and Ellipsat -- all of whom propose multiple-entry systems employing CDMA spread spectrum modulation techniques in the RDSS bands -- should be rejected. As shown below and in the attached Technical Statement, AMSC's assertions are rife with unfounded assumptions and other mischaracterizations. They should be summarily rejected.

AMSC asserts first that the 1610-1626.5 MHz band does not contain sufficient spectrum for M-E RDSS system use, because non-geostationary systems providing mobile satellite services will not be able to share the lower 6.5 MHz of the band with radioastronomy and radionavigation satellite systems. AMSC Opposition at 8. Contrary to AMSC's claims, TRW's M-E RDSS system will be able to share the lower portion of the 1610-1626.5 MHz uplink band with the radioastronomy and radionavigation services. AMSC has utilized a protection requirement that is more stringent (by 10 dB) than the current international limitation, and it has ignored the fact that only a relatively small portion of the capacity of the Odyssey system will be utilized for airborne mobile services (which present the greatest potential for interference to radioastronomy operations). See TRW Technical Annex at A-2.

AMSC also asserts that the existing PFD limitations in the 2483.5-2500 MHz band "make it virtually impossible to use any of the downlink band for a high-capacity mobile satellite service[,]" and claims that "the Constellation and TRW proposals for improving the utility of the downlink band are unworkable." AMSC Opposition at 8. These assertions are completely without merit. There will be no "dense constellations" of TRW spacecraft operating at low elevation angles; typically, two to three Odyssey spacecraft will be in view at any one time, and communication will occur only when

the elevation angle of those satellites is 30 degrees or greater relative to a given coverage region. TRW Technical Annex at A-1. Moreover, AMSC has assumed much greater terrestrial usage of the 2483.5-2500 MHz band, both domestically and internationally, than actually exists. See id. AMSC's overstatement of both the interference to be observed from TRW's Odyssey satellites and of the number of terrestrial users renders its arguments too unreliable for further consideration.

Finally, AMSC's claim that TRW has overstated both the capacity of its system and the ability of multiple systems to share the RDSS bands (see AMSC Opposition at 10-11), must be rejected. As explained in TRW's Technical Annex, the assumptions upon which AMSC's capacity claim is based have all been shown to be either completely unfounded or improperly exaggerated. See TRW Technical Annex at A-9 - A-10. And AMSC has offered no basis whatsoever for its assertion that "the designs of the [TRW, Constellation, and Ellipsat] systems will not permit the frequency sharing that the Commission has established as a requirement for RDSS systems." See AMSC Opposition at 11.

AMSC is the only member of the June 3, 1991 processing group that would not provide RDSS services (thereby requiring the Commission to abandon the objectives it identified more than six years ago), and is one of only two applicants whose

proposals would be inconsistent with the Commission's longstanding policy favoring competitive multiple entry. As such, AMSC's proposal would finish last in a comparison with any of the other five members of the June 3 processing group. As a result, the only way AMSC's June 1991 amendment can be approved is if all five of the other applicants are disqualified on legal, financial or technical grounds (i.e., are found to lack the requisite basic qualifications to be Commission licensees).

AMSC's technical opposition is a transparently heavy-handed attempt to achieve this objective. When AMSC's assumptions are replaced with actual facts and proposals, its claims fall apart. In short, AMSC's Opposition poses no bar to the grant of TRW's Petition.

2. Motorola's Technical Objections To TRW's Petition Should Be Rejected, But Its Request For Expedited Commission Consideration Should Be Granted.

Like AMSC, Motorola has filed a proposal for the RDSS bands that would, if granted, preclude the approval of any of the other five pending applications. Although Motorola proposes to provide RDSS services over its proposed Iridium system, in a comparison with the other four members of the June 3, 1991 processing group to determine which proposal or proposals are most consistent with the public interest,

Motorola's non-competitive proposal would finish last. Thus, Motorola is under some of the same pressures as AMSC to disqualify the RDSS band applicants that propose systems using pro-competitive CDMA spread spectrum modulation techniques.

a. Motorola's Technical Assertions Must Be Rejected.

Motorola makes several attacks on the proposals (including TRW's Petition) that specify CDMA operation in the RDSS bands. It claims first that TRW is in violation of the Commission's current RDSS rules because it does not propose to spread the Odyssey system's CDMA signals over either the 16.5 MHz RDSS uplink band or over the 16.5 MHz RDSS downlink band. See Motorola Comments at 4 & n.3.

As TRW observed the last time Motorola made this assertion, neither the Commission's RDSS Licensing Order nor Section 25.141 of the Commission's rules contains any requirement that RDSS systems spread their systems' signals over the entire 16.5 MHz band. See TRW Response re Motorola and Ellipsat I Applications at 7 & n.6, filed August 5, 1991. In its RDSS Licensing Order, the Commission did reject a proposal to split the RDSS bands between non-spread spectrum (e.g., frequency division multiple access ("FDMA")) MSS services and spread spectrum RDSS services, concluding that "spread spectrum systems should operate using the entire

bandwidth allocated for RDSS[.]" See Amendment of the Commission's Rules to Allocate Spectrum for, and to Establish Other Rules and Policies Pertaining to, a Radiodetermination Satellite Service, 104 F.C.C.2d 650, 660 (1986) ("RDSS Licensing Order"). This ruling may be the source of the incidental skepticism (cited by Motorola) that the Commission expressed for Ellipsat's "FDMA/CDMA modulation architecture" in an interim order in its WARC-92 Inquiry proceeding. See Motorola Comments at 4 n.3 (citing Supplemental Notice of Inquiry, GEN Docket No. 89-554, 6 FCC Rcd 1914, 1917 (1991) ("Supplemental Notice")). Whatever the Commission's intent, the statement in the WARC-92 Inquiry proceeding has nothing to do with TRW's all-CDMA spread spectrum proposal for the RDSS bands, and does not override the Commission's RDSS Licensing Order determination that it "will not mandate specific system parameters or coding schemes" for RDSS systems. See RDSS Licensing Order, 104 F.C.C.2d at 662.

Next, Motorola's assertion that "TRW's proposed rule changes are not consistent with the United States positions at WARC-92[,]" is wrong. The fact that the Commission's final recommendations for WARC-92 did not specify spread spectrum operation in the RDSS bands, opting instead to specify compatibility between MSS and RDSS users (see WARC-92 Inquiry Report, 6 FCC Rcd at 3906), has no impact whatsoever on TRW's

Petition. The requirement for spread spectrum operation in the RDSS bands is presently codified in Section 25.141 of the Commission's rules, and is not affected in any way by TRW's Petition. In any event, the Commission's adoption of the WARC-92 Inquiry Report does not change the rule, nor does it prevent the Commission from imposing a licensing requirement that is more stringent than, but not inconsistent with, the International Radio Regulations.

Motorola mischaracterizes TRW's Petition when it asserts that "TRW argues that voice service cannot be offered in [2483.5-2500 MHz] band unless these PFD limits are relaxed . . . ." See Motorola Comments at 14. As TRW explained in its Petition (see TRW Petition at 12-13), the modest relaxation of the PFD limit it requested would allow TRW to double the number of simultaneous users that can be accommodated in any single coverage beam. Moreover, Motorola's assertion that the Commission should reject TRW's proposal to implement a modest relaxation of the PFD limits in the 2483.5-2500 MHz band, because the proposal "fail[s] to take into account possible services to portable handheld units[]" (see Motorola Comments at 14), is completely without merit. As explained in detail in the attached TRW Technical Annex, TRW's Odyssey system would be able to provide service to handheld units even at the current PFD limits. TRW Technical Annex at A-12 - A-13.

b. Several Of Motorola's Processing Suggestions Have Merit, And Should Be Implemented.

Although its arguments regarding the proposals for the use of CDMA spread spectrum modulation techniques are deficient, Motorola has made several processing suggestions that merit Commission consideration. First, TRW agrees with Motorola's call (Motorola Comments at 18) for expeditious Commission action on the pending petitions for rule making and associated applications. It is imperative that the United States demonstrate a strong commitment to the RDSS service if its proposals are to be given serious consideration at WARC-92. See infra at Section II.D.

TRW also agrees with Motorola's assertion that any applicant that does not propose to offer true radiodetermination satellite services in the 1610-1626.5 MHz and 2483.5-2500 MHz bands must be summarily disqualified from this proceeding. See Motorola Comments at 17, 24. Global Positioning Service (proposed by AMSC through another satellite system) is not RDSS.

Finally, as it did in its August 5 Response regarding Motorola's application, TRW again agrees in concept with Motorola's other processing recommendations. See TRW Response at 9-10. TRW, however, remains concerned that processing matters not be elevated to a position of such prominence that other matters affecting the public interest are overlooked or given short shrift.

C. TRW Has Satisfactorily Addressed NAS's Concerns About The Possibility That Operation Of TRW's Odyssey System Will Cause Harmful Interference To Radio Astronomy Operations In The 1610-1613.8 MHz And 4990-5000 MHz Bands.

NAS does not object to the proposals of TRW, Ellipsat, and Constellation to allow M-E RDSS uplink operations in the 3.8 MHz portion of the RDSS uplink band that is shared with radio astronomy, so long as the radio astronomy allocation in the 1610-1613.8 MHz band is upgraded to co-primary status at WARC-92, as proposed (see WARC-92 Inquiry Report, 6 FCC Rcd at 3906), and that the proponents of mobile satellite services in the RDSS bands "are able to demonstrate that they would in fact be able to provide radio astronomers the required level of protection." NAS Comments at 3 (footnote omitted). NAS asserts, however, that none of the petitioners -- including TRW -- has yet demonstrated how nongeostationary M-E RDSS systems operating in the 1610-1613.8 MHz band can successfully avoid causing harmful interference to radio astronomy observatories. Id. at 6.

To the extent that NAS includes TRW among the petitioners that have yet to demonstrate that their proposed systems can avoid the use of so-called "avoidance zones" around radio astronomy observatories, NAS has overlooked the Erratum TRW filed to its Odyssey application on July 9, 1991. Indeed, NAS provides no indication that it has even seen the Erratum.

At pages C-4 through C-6 of Appendix C (revised), TRW explains the steps it will take to ensure that the Odyssey system can share spectrum successfully with the radio astronomy service in the 1610-1613.8 MHz band. See Erratum and Technical Clarification to TRW Odyssey Application (File Nos. 20-DSS-P-91(12), CSS-91-015), filed July 9, 1991.

The Erratum to TRW's Odyssey application also addresses NAS's concern that the proposal of TRW and others to use the 2483.5-2500 MHz band for M-E RDSS downlink operations "raises a potential problem inasmuch as the second harmonic of these downlink transmissions would fall in the 4990-5000 MHz band." NAS Comments at 7. Where NAS noted in its comments that it may be possible to reduce interference by employing "adequate filtering in the satellite," TRW stated in its Erratum that "harmonic filters will be used in the spacecraft S-Band transmitters to ensure that the emissions in the 5000 MHz radio astronomy band will be reduced to acceptable levels." Erratum at Appendix C, p. C-6.

In short, TRW recognizes that the concerns raised by NAS need to be addressed -- although it is somewhat shortsighted of NAS to embrace the AMSC proposal when AMSC has yet to pledge adequately to filter out-of-band emissions (see NAS Comments at 6). Like the Commission, however, TRW "is convinced that sharing among RDSS, MSS, and radioastronomy is possible and that the needs of all three services can be

satisfied." See WARC-92 Inquiry Report, 6 FCC Rcd at 3906. TRW trusts that Appendix C to the Erratum that was overlooked by NAS contains the demonstrations and commitments NAS claims it is looking for from the applicants that propose to provide M-E RDSS services in the 1610-1613.8 MHz and 2483.5-2500 MHz bands.

D. The Commission Should Not Delay The Commencement Of An RDSS-Band Spectrum Allocation Rulemaking Proceeding.

In its comments, Comsat states that it supports the initiation of a "comprehensive rulemaking proceeding and considers it the best way to expedite service and treat the broad range of interrelated issues raised by the [applicants] . . . ." Comsat Comments at 2. However, due largely to the fact that neither the Commission's nor the final U.S. Government recommendations for WARC-92 include a proposal to reallocate the 1515-1525 MHz band to the Mobile Satellite Service (as proposed by AMSC), Comsat opines that "it would be in the interests of all the parties concerned to postpone the rulemaking on allocations until after [WARC-92] when the Commission traditionally undertakes domestic rulemaking [sic] to reflect appropriate decisions taken at WARC Conferences . . . ." Id. at 4.

With all due respect to Comsat, TRW opposes the suggestion that the Commission suspend action on the spectrum allocation aspects of TRW's Petition until after the WARC. As Comsat is no doubt aware, WARC-92 will be a politically charged affair, where perceptions of spectrum requirements and appearances inevitably play an important role in multilateral discussions and negotiations. If the Commission were to place the RDSS band rulemaking petitions or applications on hiatus until next Spring or later, it would send a message to the international community that the United States Government is not serious about its proposals for the 1610-1626.5 MHz and 2483.5-2500 MHz bands. TRW is very serious about its proposal, and urges the Commission to reject emphatically any proposal that could be interpreted either here or abroad as a softening of the Government's resolve to proceed with its RDSS-band proposals.

As for Comsat's fall back suggestion that the Commission proceed now with "a comprehensive rulemaking to address the service and licensing aspects of the various proposals" (see Comsat Comments at 4-5), TRW believes that such a proposal is unnecessary. If the Commission were to adopt the approach suggested in TRW's Petition, and establish the M-E RDSS allocation in the manner proposed for the RDSS bands, there would be no service rules to address. One of the inherent appeals of TRW's proposal is that the existing RDSS

service regulations in Section 25.141 of the Commission's rules could be applied to applicants for the M-E RDSS service largely without revision. This would accelerate the establishment of the M-E RDSS service, and conserve Commission resources. See TRW Petition at 16-18. This aspect of Comsat's comments should be rejected, as should Comsat's attempt to have its comments concerning applications filed by Motorola and Ellipsat incorporated by reference into rulemaking comments addressing, inter alia, TRW's Petition. See Comsat Comments at 5 n.4.

III. CONCLUSION

On the basis of the foregoing discussion, TRW respectfully urges the Commission to approve TRW's Petition, and issue a notice of proposed rule making that proposes the establishment of the M-E RDSS under the terms and conditions advocated therein. Neither AMSC nor Motorola have presented any reason sufficient to require the denial of TRW's pro-competitive, multiple entry proposal in favor of the non-competitive, single system proposals they each have before the Commission. As the proposal most consonant with the

Commission's policies and the public interest, TRW's Petition should be granted as expeditiously as possible.

Respectfully submitted,

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ATTACHMENT

Technical Annex

0.0 Introduction

This technical annex is divided into two sections; 1.0 Response to AMSC and 2.0 Response to Motorola.

1.0 Response to AMSC, Introduction

First, some misconceptions AMSC has concerning the Odyssey system should be cleared up. One of these misconceptions is that the Odyssey system will utilize a "dense constellation of non-geostationary satellites"[1]. The Odyssey System will be composed of a total of twelve on-orbit satellites. Of these twelve satellites, the maximum number visible from any point on the Earth's surface, at any one time, is three. Occasionally, only two satellites will be visible to a ground point. On the average, the number of Odysseys satellite visible from a single ground point will be 2.8. Of the maximum of three satellites visible, the system is designed to have no more than two operating simultaneously over the same region. Thus, AMSC's claim that TRW's "dense constellation" of satellites will cause harmful degradations to other communication systems and limit the reliability of service is without basis.

The second AMSC misconception concerns the types of antennas that will be used on the Odyssey satellites. On page 16 of the Technical Appendix AMSC states that "[T]he 'footprints' of satellite antenna beams generated in the 2483.5-2500 MHz band by the proposed non-geostationary MSS satellites range from 800 km (500 miles) in diameter to *full Earth coverage*" (emphasis added). It is difficult to tell, from this passage, if AMSC is referring to Odyssey or some other system. To be specific, all of the service and feeder links on the Odyssey satellites are supported by highly directional antennas. The Odyssey S- and L-Band antennas form 19 beams at each frequency with about 25 dB gain, edge-of-coverage. The feeder link antennas produce 32 dBi beams. And, it is because of the steerable nature of all of the beams that the system can continuously operate with elevation angles above 30 degrees.

[1] Opposition of American Mobile Satellite Corporation, Technical Appendix at 13